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PROGRESS REPORT

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CURRENT SERIAL RECORDS

NATURAL RESOURCE ECONOMICS DIVISION

ECONOMIC RESEARCH SERVICE

This progress report includes a summary of the current research of the Division and a preliminary report of progress made during the preceding year. It is primarily a tool for use of scientists and administrators in program coordination, development and evaluation; and for use of advisory committees in program review and development of recommendations for future research programs.

The summaries of progress on USDA and cooperative research include some tentative results that have not been tested sufficiently to justify general release. Such findings, when adequately confirmed, will be released promptly through established channels. Because of this, the report is not intended for publication and should not be referred to in literature citations. Copies are distributed only to members of Department staff, advisory committee members and others having a special interest in the development of public agricultural research programs.

This report also includes a list of publications reporting results of USDA and cooperative research issued between October 1, 1967 to September 30, 1968. Current agricultural research findings are also published in the ERS publications Agricultural Economics Research, a quarterly, and The Farm Index, a monthly. This progress report was compiled in the Natural Resource Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D.C. 20250.

UNITED STATES DEPARTMENT OF AGRICULTURE

Washington, D.C.
October 1, 1968

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INTRODUCTION

The Department's program of natural resource economics research is concerned with the social, economic, and institutional aspects of the use, conservation, development, management and control of natural resources; and with the contribution of natural resources to regional and national economic growth.

While our natural resources are abundant, shifts in use, resource development, and institutional modifications are required to meet changing needs for these resources. Underlying the pressures for development and change in use of resources are improved technology of agricultural production and growing urban and industrial demands for land and water. Quality considerations are increasingly important in planning the use and development of natural resources; as are considerations of future needs for natural resources and the problems of meeting these needs. These trends present a challenge to provide useful and reliable research findings to aid in natural resource management, planning, and policy decisions.

The Natural Resource Economics Division carries out a national and regional program of research, planning assistance, and related policy assistance on natural resource problems. The program is headquartered in Washington, D.C. and is carried out through four subject-matter Branches, the Resource Data Systems Group, and six Field Resource Groups engaged chiefly in coordinated interagency water resources planning studies carried out under the overall guidance of the Water Resources Council.

Progress during the fiscal year 1968 is reported under 11 area headings shown in the Table of Contents. Each area or portion conducted as a research project is further identified by research problem area (RPA), described in A National Program of Research for Agriculture.

During the year, Division staff responded to requests from program administrators, the Water Resources Council, the Federal Council for Science and Technology, Agency for International Development, Bureau of the Census, and others. Basic data and analyses provided by the Division continue to be utilized in understanding changes and achieving improvements in the development, conservation and use of natural resources.

In addition to the on-going program of research and planning studies, special attention was given to several problems.

Basic information, analyses, and staff assistance was provided for the first comprehensive national assessment of water supplies and requirements. For this activity, carried under the leadership of the Water Resources Council, the Division provided projections of farmland use, water needed for irrigation and livestock, needs for land drainage, and measures to preserve the natural environment. Comparable projections for other water using sectors was provided by the Federal Department or agency most immediately involved. The report, which was not yet released at the time this progress report was prepared, is expected to make a significant contribution to the better awareness of our national and regional water problems.

Increased attention has been given in recent years to the identification and measurement of secondary benefits and costs of public investments. Much of the interest has been with natural resource investments, an interest attributed to evaluation requirements written into the Flood Control Act of 1936 and others. Efforts to measure secondary benefits and costs have met with limited success; indeed it is sometimes questioned that they can even be identified. Aspects of theory, agency practices and methodology relevant to evaluating secondary benefits were taken under study and reported at a symposium. Papers prepared for the symposium are cited on page 46.

Some of our most urgent land resource problems stem from urban expansion into rural areas with resultant changes in land use, value, and form of control. Increasingly, planners, researchers, and citizens tend to view the spatial characteristic of land as a valuable natural resource, to be conserved and used wisely. More information is being compiled on shifts of land to urban and spatial uses. The periodic inventory of major land uses estimates 2.1 million acres of land shifted to urban uses from 1959 to 1964. Aerial photo measurements were made of land shifts to urban uses in several water resource regions. Attention was given also to policy issues related to spatial planning of land use: What is open space and how can it be acquired? What does land settlement mean for today's conditions? Other studies are examining the forces influencing land development patterns in rural areas experiencing urban expansion.

AREA NO. 1. ECONOMICS OF LAND UTILIZATION

USDA and Cooperative Program

Location of Intramural Work	Scientist Man-Years FY 1968			
	RPA 104	RPA 113	Basin Planning	Total
Virginia (Rosslyn)	4.0	2.8	3.0	9.8
Hawaii	1.0			1.0
Minnesota	1.0			1.0
West Virginia	0.0			0.0
Total	6.0	2.8	3.0	11.8

Intramural program supplemented by 0.8 SMY at State Experiment Stations. 1/

1/ RPA 104, 0.2 SMY; RPA 113, 0.6 SMY.

Problems and Objectives

Population growth, advances in agricultural production technology, changing consumer demands, increased urban concentration, and other factors combined to cause changing demands for the Nation's fixed supply of land. Analyses of current levels and trends in the major uses of land, of the economics of land development conservation measures, and of land-use shifts provide the basis for informed policies and programs for land-use adjustments and the conservation and development of land resources.

Major objectives of the research are to:

1. Keep a current account of the use of the Nation's land resources.
2. Make economic evaluations of alternative means for conserving and developing land resources strategic to economic development.

Progress - USDA and Cooperative Programs

RPA 104--ALTERNATIVE USES OF LAND

A. Inventory and Appraisal of Land Supplies and Uses

1. The five-year inventory of major land uses for 1964 was completed and is in process of publication. The national land area of approximately 2,266 million acres is distributed among major uses as follows: cropland, 444 million acres; permanent grassland and other nonforested pasture and range, 640 million acres; forest land (exclusive of about 30 million acres in parks and other special uses), 732 million acres; various special-purpose uses, 173 million acres; and miscellaneous other land, 277 million acres. The 444 million acres of cropland includes 335 million used for crops, 57 million used for pasture, and 52 million in soil improvement crops and temporarily idle. In addition to the acreages of cropland used only for pasture and permanent grassland pasture, nearly one-third of the forest land is grazed. Between 1959 and 1964, total cropland decreased from 458 to 444 million acres--some 3 percent. Cropland used for crops declined even more rapidly, from 358 to 335 million acres, mainly as a result of acreage diversion programs. The acreage of permanent grassland pasture and range increased 7 million acres. Among nonagricultural uses, the acreage of forest land remained largely unchanged but land in special uses increased sharply.

2. The annual data series on acreages of cropland used for crops by regions was reviewed and estimates for 1967 were made for inclusion in USDA Statistical Bulletin No. 233, June 1968. The acreage of cropland used for crops at 342.1 million acres was up 3 percent from 1966 and the highest since 1960. All regions except the Northeast showed an increase.

Data were compiled for the second consecutive year on major uses of cropland by regions and for the U.S., based on questions added to the SRS June 1968 Enumerative Survey. This is a stratified random area segment sample yielding a coefficient of variation of about 5 percent at the national level and a

usable degree of precision at the regional level. The nonharvested categories of cropland (failed, summer fallow, soil improvement crops only, and idle) account for a third of the Nation's total cropland acreage. Previously, these data were available only in Census years. Annual data reflect variations from year to year in response to changes in diverted acreage programs. The Enumerative Survey utilizes a sample of the total land area of the country and has potential for acquiring other types of land-use data not now available; for example, urban fringe land use, the uses of non-Federal nonfarmland, and pasture and rangeland by some classification as to quality.

3. One staff member participated in a Departmental project of updating the National Inventory of Soil and Water Conservation Needs. The Inventory consists of three major phases: (1) land use, (2) conservation treatment needs by soils, and (3) watershed project needs. Statistics on land use and watershed projects needs have been developed and the evaluation of conservation treatment needs is nearing completion. Individual reports will soon be available from several States.

4. Extent and location of urbanization of land is being determined by analysis of "urban and built-up land" acreage data in the Conservation Needs Inventories (CNI) for 1958 and 1966. This includes refinement of present estimates of acreage allocated to nonagricultural uses, determination of the rate of such shifts in acreage and derivation of per capita acreage factors for projecting future shifts to urban use. Information from this research will be used as inputs for the National-Interregional Analysis of Resources Development Potential (Area No. 8) as well as for the basic inventory of major land uses.

Use of airphoto comparison analysis was continued to estimate the acreage of rural land shifting to urban and associated uses in selected areas. Airphoto analysis and area measurement has been completed for the Colorado River Basin and the Island of Oahu, Hawaii. Eight counties in the Northeastern Slope Basin area selected by cluster analysis are being analyzed by airphoto interpretation to determine the amount of land shifting from agricultural to urban and associated uses. Airphoto analysis was employed to estimate the acreage of new farmland developed by clearing and draining forest land in the Lower Mississippi alluvial area. Airphoto index sheets for years 1949-51 and 1965-66 were compared to determine the acreage cleared and the remaining area in forest. Six sample counties were studied in Arkansas and two each in Louisiana, Mississippi, and Missouri. Airphotos were also used to determine land use and other cultural features in sites for proposed U.S. Army Corps of Engineers impoundments in Vermont, New Hampshire, and Massachusetts. Data will be used in estimating the economic impact of reservoir construction.

B. Land Requirements, Conservation, and Development

1. A study was initiated in cooperation with the West Virginia Agricultural Experiment Station of reservoir impacts on land use and values in Appalachia. Analyses will be made of the extent to which the Sutton Reservoir has caused shifts and intensification in the use of land in the surrounding area, increases in land values, and changes in the tax base.

2. A report, Hawaii's Experience in Zoning, was approved for publication as Hawaii Agricultural Experiment Station Research Report No. 172. Hawaii is the only State in which the entire State is zoned by a centralized agency. From 1962 through 1967, there were 123 petitions for nonconforming uses of which 74 were approved. From the establishment of the final zone boundaries in 1964, through 1967, there were 88 petitions for boundary changes of which 64 were approved. On Oahu where pressure of urbanization was greater, some 3,400 acres were petitioned for rezoning of which 1,600 acres were approved. Zoning has afforded some protection from urban sprawl and premature conversion of farmland. Closer cooperation between State and counties, more continuity of tenure of key personnel and better communication with landowners would make zoning more effective. Dedication of land to agriculture in return for tax savings has had limited effect to date.

Study of factors affecting agricultural land values in Hawaii continued in cooperation with the Hawaii Agricultural Experiment Station and the Land Study Bureau, University of Hawaii. In the western portion of the Island most purchases were speculative, often by nonresidents who bought land "sight unseen." In the eastern part of the Island, purchases were mainly by local residents with the majority using the land for agriculture. Most sales involved small acreages, with most of the land in large holdings, tightly held. Five equations were developed which enable potential buyers and sellers, and tax appraisers to derive estimates of value for land classified "pasture," "cane," and "undeveloped" in various parts of the Island.

An analysis of leasing practices of grazing land on the Island of Hawaii is in progress. Approximately 600,000 acres or about 50 percent of all land in farms on the Island are leased. Major lessors are the State of Hawaii and the Bishop Estate, the latter using its proceeds for education of descendants of the Hawaiian race. Preliminary findings are that the majority of tenants of both State and private land are satisfied with their leases with a greater proportion of tenants of private land indicating satisfaction. Leases of the Bishop Estate provide flexibility through periodic renegotiation clauses, variable payments based on beef prices, low initial rentals coupled with specific requirements for land improvement, and other features which may have application for grazing leases in other parts of the United States.

3. A draft summary of the first survey of new towns, planned communities, and other large developments in the United States was sent to directors of cooperative extension services in each State for review and to State Planning offices for the purpose of checking accuracy of the data. The best reporting was for 1960-1967 construction starts, which showed 376 developments commencing during that period on nearly 1.5 million acres of land. Of these, 70 percent (265) were in 13 States having 10 or more such developments. Most of these developments are not in highly urbanized areas--only 38 percent are within Standard Metropolitan Statistical Areas. Twenty-four percent of the reported developments were for recreation or second-home use.

4. A manuscript, Open Space--Its Definition and Preservation, is being processed for publication. This report defines open space and develops a framework for analysis of specific land uses serving open space functions and provides guides for incorporating such uses in area plans. Methods for preserving open space are also set forth.
5. In a study of the economic supply of land for urban expansion, cooperative with the Minnesota Agricultural Experiment Station, a general equilibrium land market model has been developed encompassing the actions of predevelopment landowners, developers, and home buyers. This model enables identification of variables influencing land development patterns. Special statistical techniques are being explored to handle these variables. A simulation model for predicting land development patterns is also being adapted to the analysis. The study area is within the St. Paul-Minneapolis region.
6. Work continued on the evaluation of the Farmland Assessment Act of New Jersey, cooperative with the New Jersey Agricultural Experiment Station. The questionnaire and sampling design were developed. A total of 570 owners of farmland were queried by mail questionnaire and follow-up personal interview. Data are currently being analyzed. Characteristics and attitudes of landowners who participate and do not participate in the farmland assessment program are being isolated and compared. Twenty purposely selected respondents who operate dairy farms are supplying supplementary data concerning their farm operations to be used in a linear programming model to determine alternative enterprise combinations that could result as the farmland assessment program is modified.

RPA 113--REMOTE SENSING

1. A study of resource management by the use of airphotos was completed. Data for the study were obtained by survey of non-Federal purchasers of Agricultural Stabilization and Conservation Service airphotos. In FY 1966, 40,000 non-Federal customers purchased 471,000 airphotos. The report presents the nature and extent of airphoto uses with respect to numbers and sizes of photos ordered and types of customers. The uses are discussed in terms of (1) use and need as implied by types of customers, and (2) uses as reported by types of customers. Also included are sections on customers' opinions of the tone and resolution of the photo and the time that the photo was taken; and the number of photos acquired from other sources.
2. An analysis was made of the adequacy of fundamental types of data on crop areas, crop production, and land use in a sample of 34 countries drawn from Asia, Oceania, Europe, North America, Central America, and South America. Such data are evaluated as to their adequacy as a basis for assessing the potential for obtaining improved data via remote sensing. A report is in process of being published.
3. Cornell University completed a contract study of potential worldwide benefits from remote sensing. The analysis indicates substantial increased returns and savings in costs in agricultural, forest, and range production. Associated benefits would be diffused in the form of improved diets and more adequate clothing. Dissemination of improved information may be a major bottleneck to

realization of benefits. Over 300 applications of remote sensing were identified, most of which could be made operational within 20 years. Costs were compared for compiled representative programs for obtaining data via remote sensing from aircraft.

4. Work is underway by Cornell University, under contract, to develop a land-use classification system using simulated satellite imagery. Categories of agricultural and nonagricultural land uses will be established that are feasible to identify and measure from this type of imagery and a classification system developed for use of satellite imagery for inventory of major land uses.

RIVER BASIN PLANNING AND SERVICE ACTIVITY

1. Personnel of the Land Resources Branch participated for the second year in a long-term OBE-ERS study, National Interregional Analysis and Projections (reported under Area No. 8). Major activities involved development of basic data by soil resource groups for 70 physiographic regions. The data consisted of: (1) Major agricultural land uses and prospective shifts in use; (2) non-agricultural land use and expected change associated with growth in population; (3) productivity of the major agricultural crops (per acre) and expected gains due to increased fertilizer use, technological change and so on; and (4) production costs of the major agricultural crops.

2. One staff member spent approximately 6 months working with the USDA Task Force on Communities of Tomorrow analyzing the economics in the generation and transmission of electricity. Preliminary results show that the economies to be gained by increasing the size of generating plants begin to diminish quite strikingly at a plant size of about 200 megawatts, and that the rate of plant utilization is a more significant variable than plant size in explaining the variations in the cost per kilowatt-hour of generating electricity. Plants as small as 200 megawatts with high utilization rates may therefore have relatively low cost per unit of electricity generated comparable to those of very large plants with a low utilization rate. Further analyses are underway to include transmission facilities and institutional constraints.

Publications--USDA and Cooperative Program

RPA 104--ALTERNATIVE USES OF LAND

A. Land Use Inventory

Changes in farm production and efficiency--a summary report. 1968.

U.S. Dept. of Agriculture Sta. Bul. 233, tables 4-6, pp. 6, 7.

Supplement II to changes in farm production and efficiency--a summary report. 1968. U.S. Dept. of Agriculture Sta. Bul. 233, 7 pp.

Frey, H. Thomas, Krause, Orville E., and Dickason, Clifford. 1968.

Major uses of land and water in the United States with special reference to agriculture: summary for 1964. U.S. Dept. of Agriculture Economic Report No. 149, 81 pp.

B. Land Requirements, Conservation, and Development

- Baker, Simon. 1968. Tea Production in Ceylon. The Journal of Geography. Vol. LXVII, No. 1. Jan. pp 49-55.
- Martin, William E., Stults, Harold M., and Young, Robert A. 1968. Source of net returns for Pinal County growers. In Progressive Agriculture in Arizona. Vol. XX, No. 5, Sept.-Oct. pp. 14-15.
- Miller, Walter G., and Osborn, James E. 1968. Secondary effects of land and water depletion. Paper presented at NRED Symposium on Secondary Impacts. Washington, D.C. Sept. 25-27.

RPA 113--REMOTE SENSING

- Baker, Simon. 1968. Remote sensing: present status and future agricultural use. The Prof. Geog., Vol. XX, No. 3. May.
- Gensurowsky, Walter. 1968. Applications of economic analysis to problems of data collection by remote sensing. In proceedings of symposium on remote sensing of the environment. Ann Arbor, Mich. June.

AREA NO. 2. ECONOMICS OF WATER UTILIZATION
AND WATERSHED DEVELOPMENT

USDA and Cooperative Program

Location of Intramural Work	Scientist Man-Years FY 1968			
	RPA 108	Watershed Protection	Basin Planning	Total
Virginia (Rosslyn)	2.7	2.0	2.1	6.8
Arkansas	--	1.0	--	1.0
Colorado	1.0	--	--	1.0
Georgia	1.0	--	--	1.0
Hawaii	1.0	--	--	1.0
Indiana	0.8	--	--	0.8
Iowa	1.0	--	--	1.0
Minnesota	0.9	--	--	0.9
Mississippi	0.2	--	--	0.2
North Dakota	1.0	--	--	1.0
Oklahoma	--	1.0	--	1.0
Oregon	0.1	--	--	0.1
Pennsylvania	--	1.0	--	1.0
Wisconsin	1.0	--	--	1.0
Total	10.7	5.0	2.1	17.8

Intramural program is supplemented by extramural support representing 2.1 SMY's at State Agricultural Experiment Station. 1/

1/ RPA 108, 1.7 SMY; Watershed protection, 0.4 SMY.

Problems and Objectives

The average annual supply of water amounts to about 30 inches of rainfall over the United States, of which about 70 percent is consumed onsite. The remaining 30 percent reaches streams or ground water where it is available for withdrawal and use. For the Nation as a whole, this has been an adequate supply of water, although some regions and communities experience water shortages. National attention has focused upon water supplies, future needs for water, and how best to provide for these future needs. There is an urgent and continuing need for economic information pertaining to water supplies and needs and to opportunities and consequences of national and regional water resource development.

Major objectives of the research are to:

1. Provide economic facts on water supplies, uses, values, and management as they concern farmers or ranchers, local and regional groups, and public officials.
2. Analyze current water problems and evaluate alternative solutions to water resource management or development problems.

Progress--USDA and Cooperative Programs

RPA 108--ECONOMIC AND LEGAL PROBLEMS IN MANAGEMENT OF WATER AND WATERSHEDS

1. Inventory of agricultural water use. Trends in drainage, irrigation, irrigation water use, and other agricultural water use, to 1964, with extrapolations to 1969 and to 1970, were compiled for the five-year inventory of major land and water uses. A statistical analysis was made of trends in irrigation from 1939 to 1964 in each of the 22 major water resource regions of the United States as a basis for converting the inventory to the 17 Water Resources Council regions. A draft administrative report details this work. Staff participated in the work of a Task Force on Water Use Data formed by the Water Resources Council to recommend improvements in water use data following a survey to determine data available and needed for future national assessments of water supplies and needs. In connection with the Task Force activity, recommendations were made to the Census Bureau for irrigation and drainage questions on the 1969 Census of Agriculture and the Census of Irrigation.

2. Climatological factors in water use. Climatologic and agronomic data on consumptive use of water by plants were compiled for use in appraising irrigation feasibility at given locations. Monthly and annual consumptive water-use estimates have been compiled for 29 locations, mostly in the Western, Southeastern, and Middle Atlantic States. A total of 86 estimates of monthly and annual consumptive use and irrigation requirements were prepared for crops in different locations as follows: alfalfa, 27; corn, 12; pasture, 9; all fruit, 10; cotton, 12; potatoes, 4; sugar beets, 3; sorghum, 3; and all other 6. A draft manuscript describes procedures and gives empirical results for

the Appalachian and Southwest regions. The manuscript is to be revised to include empirical results for all 86 determinations to date.

3. Technology and economics of conservation. Data were collected from SCS work unit conservationists on the cost of constructing grass-backsloped (GBS) terraces in north central Iowa during 1964-67. Emphasis was on factors affecting cost per foot of terrace. Statistical analysis of these data is underway. To determine effects of different soil types, cost data on GBS terraces also are being collected in western and southwestern Iowa for 1968. Data on the cost of building GBS terraces are being collected from terrace contractors in north central Iowa.

4. Water and regional development in the Northeast. An annotated bibliography of about 450 literature entries on water resources and water resource development was completed, focusing on the New England region. Following a general introduction on procedure and retrieval, the entries are separated by irrigation and soil moisture, water law, recreation, power and transportation, water quality, floods, resource inventory and supply, and management and planning for each of the New England States.

5. Economics of streamflow accretions. Streamflow data by months for a number of years were gathered for several streams in Colorado and Wyoming. The data were plotted using the Gumbel method of flow frequency analysis to identify probability distributions of streamflow by months and location. This method helps identify the water users that will and will not receive water during each month of the irrigation season. Additional data are being gathered for the study by water commissioners and will be available at the end of the irrigation season.

Preliminary analysis of the effects of changes in streamflow on marginal water rights holders will be conducted by use of simulation models. This analysis will show the effects of changes in streamflow on the marginal water rights holders if the hydrology of the stream were changed via improved irrigation practices.

6. Water management in the Southeast. A draft manuscript summarizes cost and returns of irrigation for various enterprises in the Southeast. The report in part is an extensive review of various experimental and other studies of irrigation in the Southeast, with particular emphasis on the Appalachian region but it also includes complete enterprise budgets and economic analysis of irrigation. Results show that vegetables, fruits, and tobacco offer the greatest promise for successful irrigation, especially for some relatively remote valleys being made accessible to markets through improved highway systems. The need for quality control in producing crops for frozen foods makes irrigation especially attractive to vegetable and small fruit producers. Additional studies are being made of rainfall probability distributions at various locations as they relate to the feasibility and potential of profitable irrigation.

7. Citrus irrigation in Florida. Because of difficulties in obtaining data from irrigation equipment manufacturers and farmers, efficient prototype irrigation systems were designed in cooperation with agricultural engineers

of the Florida Agricultural Experiment Station and the Florida Extension Service. In total, 18 different irrigation layouts utilizing various types of equipment and involving various sizes and shapes of fields were developed. Costs of investment, operation and maintenance at varying levels of water use were budgeted for the different layouts. Cost data for citrus crop irrigation are to be combined with estimates of yield response to determine net economic gains and, from this, overall potentials for irrigation and water resource development in Florida and other Southeastern States.

8. Economics of sedimentation. During the year, research was begun on the economic significance of sedimentation in regional and national water resource management opportunities, with particular emphasis on soil erosion from agricultural lands. An agricultural economist is stationed at the the U.S. Sedimentation Laboratory, Oxford, Mississippi, where he is cooperating with ARS scientists in the study. Objectives of the project are to evaluate economic effects of land-use changes and conservation practices, including conservation structures, on sediment yield and sediment transport in the main drainage channel of a selected sub-watershed, and examine the relationship between estimated gross erosion with its subsequent potential sediment discharge and the measured sediment load in terms of sediment retention needs. The Pigeon Roost Watershed, located in Marshall County, Mississippi, was selected for study.

9. North Central water management. The University of Wisconsin was assisted in completing a study of the economic effects of a permit system of water rights on irrigation development. A major activity, carried out for several years, has been coordination of a North Central regional project on Water Use in Agriculture (NC-57). During the year, leadership was provided in planning and conducting a seminar on water research needs in the North Central region as part of the Committee's continuing interest in water problems and research needs in the region. The seminar papers are to be published. Detailed reviews of legal and economic research projects relating to water use and management were prepared for the NC-57 Committee and cover the States of Kansas, Missouri, Nebraska, North Dakota, South Dakota, and Ohio. The reviews are to be used for an overall report on the status of water resources research in the 12-State North Central region.

10. Indiana weather data and water management. Research was initiated during the reporting year for the purpose of estimating the economic benefits to individual farms and to the agricultural economy of Indiana of specialized agricultural weather information programs. The study is cooperative with the Indiana Agricultural Experiment Station and is coordinated with the Weather Bureau of the Environmental Science Services Administration, and with the Indiana Water Resources Institute. Field crops of major economic importance to the Indiana agricultural economy are being studied in connection with the sensitivity of short-run farm and related service industry management decisions to improved weather information. Mail surveys of producers, fertilizer dealers, and subscribers to the ESSA Weather Wire is planned and questionnaires are being prepared.

11. Water management techniques in North Dakota. Results of an economic study of sprinkler and surface irrigation systems were published as a cooperative ERS and North Dakota Agricultural Experiment Station bulletin. A related paper was prepared for the 1968 meeting of the Sprinkler Irrigation Association. Study of the economic aspects of level bench terracing for moisture conservation was continued. Various types of terraces in South Dakota and Iowa were examined in conjunction with estimating construction costs, and farm operating problems associated with terraced land were discussed with SCS personnel. Experimental results from terracing at the Agricultural Research Service research station at Mandan, North Dakota, and at other ARS locations are being used to develop estimates of benefits from the practice. Data from soil surveys in North Dakota are being studied to determine their usefulness for estimating the potential acreage suitable for level bench-terracing.

12. Economics of crop irrigation in North Dakota. A draft report summarizes several production function determinations, with water an explicit input, for major crops represented in the Garrison Diversion Project area and other potentially irrigable areas of the State. Crops include corn for silage and for grain, alfalfa, other tame hay, and spring wheat. These studies of crop response to irrigation are essential for assessing remaining potentials for water resource development over the Northern Plains region. Preliminary investigations in this study indicate that the first phase of the Garrison Diversion Project will bring an additional 250,000 acres under irrigation in the State, while the Project ultimately will bring in 1,070,000 acres. About 72,000 acres are presently irrigated in North Dakota. The total land irrigable in the State is on the order of 3,100,000 acres.

13. Irrigation impacts in South Dakota. Three counties in eastern South Dakota were selected as areas for study. Each county (Brookings, Codington, and Minnehaha) has a major trade center, and significant acreages suitable for irrigation. Necessary information on soil features, water supplies, and economic activity are available for each county. From the Brookings County soil survey, 23,000 nonirrigated acres were identified as having water supplies and soils suitable for irrigation development using large mechanical sprinklers. Investigation of the economic feasibility of irrigation appeared justified, and economic information was obtained on crops and livestock farm enterprises in these areas.

14. Water management on the Texas High Plains. In the analysis of ground water resources, attention has been given to regional income, its distribution among farm operators and landowners, and contribution to regional income by major irrigated crops. Owner-operators retain 52.9 percent of the income, renters retain 31.5 percent, and resident landlords 15.6 percent of the income remaining in the study area. About 8.8 percent of the total farm income generated in the area goes to nonresident landlords. About 69 percent of the total farm income is from cotton, 26 percent is from grain sorghum, and 5 percent is from wheat. These analyses are helpful in assessing the impacts of ground water decline with respect to various income recipients and their adjustment alternatives. Work in the coming year will evaluate the effects of ground water decline with regard to consumption patterns.

15. Water management in the Pacific Northwest. Research was initiated to evaluate and measure the contribution of water resource development to farm output in the Pacific Northwest. Five homogeneous farming areas were delineated for the study. The production function model specified includes drainage, irrigation, flood control, and conservation factors among variables which will be used to explain value of farm production in the study area.
16. Sugar cane and other irrigation in Hawaii. Two reports, one dealing with methodology for estimating optimum agricultural land use and the other with a computer program for implementing the procedure, were completed during the year. The former was published in Agricultural Economics Research and the latter is to be published by the Hawaii Agricultural Experiment Station. These reports were prepared from a completed study of cropland use on the Molokai Diversion Project in Hawaii. Findings of the study were summarized in last year's progress report. In another study, the marginal productivity of irrigation water for each of several sugar-producing areas in Hawaii is being determined. An aggregate water deficiency model to isolate the relationship between water and sugar cane yield has been developed, and includes an empirical application to plantation data. The model is applicable to several economic problems in irrigation management.
17. Simulation of irrigation water delivery. Economic efficiency or other criteria may serve as a basis for appraising alternative routines for irrigation water delivery to farms and thence by farmers among fields. A simulation model, designed in collaboration with the Graduate School of Public Administration at Harvard University, is being used in making these appraisals. In the past year the general simulation program was rewritten to remove inefficiencies and to make it compatible with new higher-speed computers using advanced FORTRAN languages. Also, the program was expanded to handle 20 alternative water delivery routines and to use a planning process to select the optimum crop pattern to be grown on each farm, given the farm's water rights and the seasonal availability of water. Manuscripts describing the simulation program, its rationale, and its application have been completed, along with a detailed flow chart of the simulation program. Papers were prepared for the International Commission on Irrigation and Drainage and the American Agricultural Economics Association.

As the work progressed, additional material was compiled for the project that describes actual irrigation systems in Colorado, Utah, California and in Spain, and the rules used to distribute irrigation water under various levels of water adequacy or shortage. Delivery rules used in actual systems are being adapted for the simulation program to test their effects on farms with many different water supply situations.

WATERSHED WORK PLAN INVESTIGATIONS

Assistance is provided the Soil Conservation Service under the provisions of an annual Work Plan negotiated with the Natural Resource Economics Division of ERS.

1. Assistance in policy recommendations. This has included participation of personnel of the Division in sessions of SCS Regional Technical Service Center Economists and Washington SCS staff in Washington, D.C. in March 1968, as well as preparation by the Resource Data Systems Group of the Division of various price or cost indexes for agricultural inputs, agricultural products, and construction.

2. Evaluation of selected Pilot Watershed Projects. Activities under this item have concerned the Upper Rio Hondo Watershed in New Mexico, the Six-Mile Creek Watershed in Arkansas, and the Mule Creek Watershed in Iowa.

- a. Upper Rio Hondo, New Mexico. Completion of a final evaluation report is anticipated sometime after January 1969. The duration of the evaluation period was increased to 12 years (1956-1967). Original intentions were to evaluate 10 years' experience (1956-1965). The report will now include field data from crop years 1966 to 1967. A good portion of ERS activity in FY 1968 was on collecting and processing some basic, as well as the additional 1966-67 information on crop production, land treatment, and flood damage, obtained principally from local or district offices of the Soil Conservation Service and the Forest Service, and from individual farm operators.
- b. Six-Mile Creek, Arkansas. A draft of the final evaluation report on this watershed is currently being reviewed. Information included in the report is of a type similar to that in the Upper Rio Hondo report. Results of the completed evaluations are grouped according to areas flooded; changes in land use and yields; watershed land use trends versus county trends; comparisons of flood plain with upland use; changes over time in crop yields; and changes in gross values of farm products.
- c. Mule Creek Watershed, Iowa. Economic surveys on this watershed in Mills County, Iowa were terminated in FY 1968. Land use, production, and management data for sample areas of the upland and all the flood plain have been collected on an annual basis, and data are available for all years beginning in 1951. Sedimentation data have been collected for five of the 24 dual-purpose structures installed in the watershed.

The evaluations indicate substantial improvement of conditions in the watershed, but failure to complete recommended installation of land treatment may result in shortening the period of sediment storage in the dual-purpose structures from 50 to 25 years, or less in some instances. A lag in terracing operations has been one of the major shortcomings of the land treatment program. Some major land-use changes have occurred, particularly within the last few years. Gross value of production has steadily increased within the watershed during the evaluation period. The rate of increase in gross production value in the watershed area has been about five times the rate for Mills County as a whole.

3. Inventory and analysis of Watershed Work Plans. As in past years, an annual inventory of selected statistical data was abstracted from all Work Plans for small watersheds authorized for operations under P.L. 566, as of June 30, 1967. To provide increased flexibility and improved services to SCS in providing special-purpose groupings of watershed information, the data processing system for accomplishing the inventory was changed. Good progress was made in converting the data system and it is expected to be fully operational in the near future. The 1968 inventory of watershed data (covering project operations through June 1968) is now in preparation. This inventory will summarize 834 watershed Work Plans and include the effects of major supplements or amendments through June 1968.

4. Flood Protection in Arkansas-White-Red River Basins. Studies were begun in 1965 to estimate the major economic effects of upstream flood protection projects by determining reductions in crop and pasture damages resulting from installed structures, benefits from irrigation and drainage on flood plain land stemming from projects, and changes in land use and intensity as a result of flood protection. Evaluating Flood Prevention in Upstream Watersheds With an Areal Point Sample (ERS-353, July 1967), reported progress in evaluations carried out in the Washita River Basin for 1964-65. The study area has since been enlarged to include a sample of planned watersheds throughout the Arkansas-White-Red River Resource Region.

A supplement to ERS-353 was completed in March 1968. The supplement indicates that the 1,600 farmers interviewed operate 1.5 million acres of land, including 380,000 acres of flood plain. Thirty-five separate floods on 24 of the 56 watersheds were reported by farmers. These floods covered approximately 38,000 acres and caused about \$183,000 damages to crops and pastures. It was estimated that these damages would have been \$23,000 more if no flood protection had been provided. Total damageable value of crops and pastures on the flood plain of sample watersheds in 1966 was \$16.4 million, with flood damages estimated to be \$183,000 or 1.1 percent of damageable values.

5. Correlation of flood damage with alternative land use. The main objective of this study, being conducted in cooperation with Oklahoma State University, is to develop a general computer model for estimating flood damages by flood plain location for alternative land use patterns (a) without a watershed project, and (b) in combination with alternative systems of structures. Subobjectives are to (a) estimate flood damages for specific storms, average annual flood damages, and damage reduction benefits on specific sub-watershed areas within the flood plain of the watershed, for alternative systems of structures and land-use patterns; and (b) to develop an optimizing routine to select proper land use by location in the watershed so as to maximize expected net returns with respect to potential flooding. Nuyaka Creek, a part of the Okfuskee Tributaries and located in Okfuskee and Okmulgee Counties in northeastern Oklahoma, is the study area for this project.

In FY 1968, the general computer model was completed and is operational except for the optimizing routine.

Information collected and developed (for Nuyaka Creek) to be used as input data include: (1) Productivity groupings based on soil types, crops and expected yields; (2) sample points for each five acres of the flood plain; (3) present land use, coordinate location, and appropriate productivity group for each sample point; (4) station elevations, interval between stations for each cross-section bank, channel elevation, and elevation of each flood size considered for a series of flood plain cross-sections; and (5) general watershed data such as damage factors by inundation interval for each crop considered, percent change of occurrence of each flood size considered in any specific year, percent change of occurrence of any flood in each season, and price per unit for crops considered.

6. Flood plain and other conservation zoning. Evaluation of the contribution of flood plain, conservation, and recreation zoning to the management of small watersheds was partly completed. A survey was made of local officials in areas where flood plain zoning exists. Only preliminary findings are available; however, it appears that proper enforcement of zoning ordinances has reduced flood damages (Reported also in Area No. 3).

7. Economic impacts of watershed projects. Additional emphasis in watershed research is being placed on studies to determine the effects of watershed investments on local economic development. Study outlines have been prepared to cover several aspects of the evaluation including (a) classification of the kinds of project effects, (b) secondary effects of projects on the local economies, and (c) the influence of watershed protection and development on stabilization of the rural community. Emphasis is placed on inquiries concerning "induced" effects of projects on the local economies, and project planning methods as they may affect desired project results.

A closely related study, conducted in Pennsylvania, is assessing the socio-economic impacts of water resource development on local areas and communities--via analyses of the incidence of costs and benefits. Major attention on the study so far is on theoretical aspects of extra-market effects, spillovers, or third-party effects as they are sometimes referred to, in water resource development. A selected review and interpretation of the theory concerning extra-market effects has been made and a paper prepared on evaluation of these effects in water resource investments. Another paper, "Secondary Effects: Concepts and Basis in Welfare Economics" prepared for the NRED Symposium on Secondary Impacts, concludes that a broader framework than traditional benefit-cost analysis is necessary if the total impact of projects are to be evaluated. This arises partially because of the existence of externalities and public goods aspects associated with water resource projects. Also prepared for the Symposium was a paper titled "Evaluation of Secondary Benefits of the Accelerated Watershed Program in Appalachia." Further, a paper on "Implications of Use of Multipliers" was prepared for and presented at a Northeastern Field Group meeting of NRED at Upper Darby, Pennsylvania, in September 1967. This paper discusses some of the advantages and limitations of using multiplier analysis in the evaluation of water resource project effects.

RIVER BASIN PLANNING ACTIVITIES

The bulk of the Division's work on river basin planning is reviewed under Areas 8, 9, and 10 of this report. Two additional activities conducted in conjunction with Area No. 2, Water Utilization and Watershed Development, are as follows:

1. Cost sharing in water projects. A new study was initiated and is aimed at refining the methodology for water development planning as it involved efficiency of resource use in alternative cost-sharing arrangements, repayment procedures, and other financial aspects of implementing development programs. An annotated bibliography of the pertinent literature was prepared and consultations held with government and university specialists on the subject of cost sharing for resource development. Some comparisons of current agency practices and policies have been completed. The study is currently concerned with the conditions that should be met by cost-sharing policies for promoting efficient and equitable water resource development. The effects of alternative policies on project selection, design, and use are being determined.

2. Planning report reviews. Economic review and preparation of comments was continued for Federal agency reports on water resource development projects. Economic Research Service comments, along with those of other Services, are utilized in preparing the Department's views of the proposed project, which in turn accompany the report as it is submitted through the Water Resources Council and the Bureau of the Budget to the Congress. For FY 1968, reviews were completed and comments prepared for 22 Corps of Engineers reports, 3 Bureau of Reclamation reports, and 2 reports of the Alaska Power Administration. In addition, reviews were made and comments prepared for a number of USDA project plans or reports, and assistance was given to the Water Resources Council in its evaluations of major planning reports for the Sabine River (Texas and Louisiana) and the Pascagoula River (Mississippi).

Publications--USDA and Cooperative Program

RFA 108--ECONOMIC AND LEGAL PROBLEMS IN MANAGEMENT OF WATER AND WATERSHEDS

Anderson, Raymond L. 1968. A simulation program to establish optimum crop patterns on irrigated farms based on pre-season estimates of water supply. Amer. Jour. Agr. Economics 59(5). December.

Frey, H. Thomas, Krause, Orville E. and Dickason, Clifford. 1968. Major uses of land and water in the United States, with special reference to agriculture: summary for 1964. U.S. Dept. of Agriculture Economics Report No. 149. 81 pp. (Also reported for Area No. 1)

Hogg, Howard C. and Larson, Arnold B. 1968. An iterative linear programming procedure for estimating patterns of agricultural land use. Agricultural Economics Research 20(1): 17-24. January.

Hogg, Howard C., Davidson, Jack R., and Rankins, Lloyd B. 1967. A composite variable for estimating the productivity of irrigation water. In Proceedings of Committee on Economics of Water Resources Development, Western Agr. Econ. Res. Council. San Francisco. December 12-13. pp. 25-38.

Larson, Arnold B. and Hogg, Howard C. 1968. Manual of instructions and suggested areas of application for a method of linear programming with iterative modification of the objective function and restraints vector. Special report of Department of Agricultural Economics, University of Hawaii, Honolulu.

McMartin, Wallace. 1968. Economic trends and future markets for sprinkler irrigation equipment. In Proceedings of 1968 Annual Technical Conference of the Sprinkler Irrigation Association, Washington, D.C. pp. 89-108.

McMartin, Wallace and Bergan, Ronald D. 1968. Irrigation practices and costs in North Dakota. Bul. 474. No. Dak. Agr. Expt. Sta., Cooperative with ERS/USDA. 48 pp.

Overboe, Orville I. 1968. Irrigation and agricultural water management in world agriculture. World Irrigation 18(2): 12-13. March.

Pavelis, George A. 1968. Summary of North Central Seminar on Water Resources Research, Chicago. March. In Opportunities for Regional Research on Water Resources Problems. Monograph No. 10, Agricultural Law Center, University of Iowa, Iowa City. September.

Rose, Gordon D. and Massey, Dean T. 1968. Regional research on water in the North Central Region. In Opportunities for Regional Research on Water Resources Problems. Monograph No. 10, Agricultural Law Center, University of Iowa, Iowa City. September.

Rosenberry, Paul E., Daugherty, Arthur B., and Pavelis, George A. 1968. Technological change and the economics of conservation. Jour. Soil and Water Conservation 23(4): 123-216. July-August.

WATERSHED WORK PLAN INVESTIGATIONS

Heneberry, William H. 1968. Evaluation of secondary benefits from the accelerated watershed program in Appalachia. Paper presented at NRED Symposium on Secondary Impacts. September 25-27. Washington, D.C.

Long, Burl F. 1968. Concepts and theoretical basis for evaluation of secondary impacts. Paper presented at NRED Symposium on Secondary Impacts. September 25-27. Washington, D. C.

AREA NO. 3. RESOURCE INSTITUTIONS

USDA and Cooperative Program

Location of Intramural Work	Scientist Man-Years FY 1968		
	Resource Problem Area		Total
	108	908	
A. <u>Water Rights and Related Laws</u>			
California	0.6		0.6
Virginia (Rosslyn)	1.0		1.0
Wisconsin	2.0		2.0
B. <u>Zoning and Organizations</u>			
Virginia (Rosslyn)		3.8	3.8
Total	3.6	3.8	7.4

Intramural program is supplemented by extramural support representing 0.6 SMY at other U.S. institutions. 1/

1/ RPA 108, 0.6 SMY.

Problems and Objectives

Changes in land and water use require revision of legal and other institutions. In order to minimize economic and other problems associated with changing the institutional structure, a continual evaluation of the laws and alternative organizational arrangements for natural resource development is needed. Research results are used in preparing and implementing resource plans. The legal, economic, and administrative aspects of zoning and other nonstructural alternatives to flood control need to be fully appraised for use in policy decisions.

Major objectives of the research are to develop and evaluate alternative ways of:

1. Identifying and measuring the historical effects of legal changes in water rights laws.
2. Using flood plain and conservation zoning for managing land uses in flood plains.
3. Protecting the community's interest in land-use changes through zoning and other means.
4. Organizing for management of natural resources in economic development.

Progress--USDA and Cooperative Program

RPA 108--ECONOMIC AND LEGAL PROBLEMS IN MANAGEMENT OF WATER AND WATERSHEDS

A number of publications regarding water rights and related laws in the Eastern United States were prepared and others are in preparation. A comprehensive manuscript for a book on water-use law and administration in Wisconsin has been approved and is being readied for cooperative publication by the University of Wisconsin. It discusses the development of court decisions and legislation and the role of State and local government, as well as Federal, interstate, and international matters and criteria and approaches in evaluating water laws. The actual administration of a number of statutory laws is examined including Wisconsin's stream irrigation permit system, high-capacity well law, pollution control laws, and provisions regarding lake levels. Drawing upon a recent legal-economic study of irrigation in Barron County, the "source-of-title" riparian-land definition employed in administering the stream irrigation permit system was found to have a restrictive effect upon irrigation development. Under this definition, the irrigation of small acreages near streams may have an advantage over larger irrigation enterprises; but the smaller enterprises may be at a disadvantage if located farther away because they may lack sufficient capital to construct and operate from a well. Beginning or other capital-constrained farmers and those who rent rather than own their irrigated lands also may be at a disadvantage.

An analysis of the 1956 Mississippi water appropriation statute was published during the reporting period. This statute incorporated some principal aspects of the Western prior appropriation doctrine for application to surface water-courses, with some modifications including a minimum streamflow provision and a provision regarding the cancellation or modification of appropriations. Pre-existing uses are treated as prior claimants but it is unclear how the available water is to be allocated among them. As of April 1967, some 90 percent of the requests for allocations had been made by such prior claimants.

A cooperative publication with the University of Wisconsin compares public rights in water in Wisconsin, Minnesota, Indiana and Ohio. Approaches were found to differ in three main respects: (1) whether such rights are created by courts or legislatures, (2) whether they are property rights or police power regulations, and (3) whether they exist in all water in which their use is feasible.

An article on the suitability of Australian and American water allocation systems for use in the Eastern United States examines the riparian and prior appropriation doctrines, temporal nonpriority permit systems, and marketplace concepts. It suggests that a nonpriority permit system may be suitable for the Eastern States.

Other published papers discuss: (1) water rights and regulation as related to water and associated land resource planning and development, and (2) legal aspects of rural-urban water use conflicts. The former was published as the foreword to a report on State laws, policies, and programs for the Ohio River Comprehensive Survey.

Additional publications regarding Western water laws were published and others are in preparation. Drafts have been prepared for all except one of the chapters of the comprehensive multivolume report on water rights in the 19 Western States. A chapter on interstate matters is in preparation and the manuscript is being updated and its legal citations checked.

A previous publication on the law of water rights in Idaho was updated and a revised version was published in the Idaho Law Review.

An article was published cooperatively with the University of North Dakota that examines the institutional arrangements for supplying and distributing water for irrigation in the Garrison Diversion Project in North Dakota. This includes the contractual arrangements regarding operation, repayment and maintenance between the Bureau of Reclamation, the Garrison Diversion Conservancy District, and participating irrigation districts.

RPA 908--IMPROVEMENT OF RURAL COMMUNITY INSTITUTIONS AND SERVICES

An inventory of Federal, State and local water organizations was completed. The report includes citations to statutory powers and regulatory authority and a brief functional description of Federal and international organizations. The State and local organizations are identified by statutory citations. Within the Executive Branch of the Federal Government there are nine Departments

with 44 Agencies concerned with some phase of water activity. In addition, there are 11 independent agencies having responsibility for various types of activities related to water. Over 600 State organizations are created by legislation, and there are about 700 enabling acts for local special-purpose water districts and authorities.

A bibliography on special districts and authorities, consisting of 250 annotations was published. A supplement is being prepared to include items published since this bibliography was completed.

An article on the history of special districts in the United States and on the potential of the special-district governmental forms for meeting other national, regional, and local problems is being prepared for review and publication.

An extramural project is examining the capacity for special districts to arrive at investment decisions which reflect the full economic costs of their actions and benefits. Another is a systems analysis of water organizations which is comparing the performance of collective organizations with the legal system as a means of resolving conflicts arising from water use.

A major manuscript on rural zoning-enabling legislation is being revised following extensive review. Updating of legal documentation is being continued. Nearly three-fourths of the 3,000 counties in the United States are authorized to zone. The kinds of rural zoning districts are agricultural, forestry, recreation, roadside, flood plain, watershed, and conservation.

Preliminary findings from a partially completed field survey of flood plain zoning districts disclose that proper enforcement of zoning ordinances has prevented flood damage. State zoning-enabling laws vary. In California the State provides an incentive for local zoning, while the State of Wisconsin may actually do the zoning if the local government does not.

A manuscript on legal-economic issues raised by technological change is being completed. The paper deals with the question of economic externalities and alternative institutional arrangements for handling them.

A study of local conservation zoning districts with implications for their use in national natural resource conservation programs was made. It includes a review of State zoning-enabling legislation dealing with conservation and examines the structure of 25 local ordinances.

Institutional changes required for modifying land settlement policies involve changes in (1) our attitudes and concepts of where people live based on (a) the role of communication in density, (b) man's perception of his environment, and (c) new conceptions of planning; and (2) specific institutions such as property rights, organizational patterns, and investment decisions. These ideas were developed in a paper presented at the annual meeting of the Soil Conservation Society of America.

Issues in land settlement policy and the theoretical implications were developed in two seminars organized in conjunction with the Southern Land Economics

Research Committee. One seminar dealt with the possibilities of using utopias as models for policy development; concepts of space and the effects of biological and social theories on population growth; theoretical economic implications for population dispersal; income distribution implications; rural-urban problems; and property rights concepts. The second seminar focused on economic theories of space and the need to develop models for dealing with space, and historical development of national attitudes and policies about the use of space from the viewpoint of a political scientist. Results of these exploratory investigations indicate that both empirical and theoretical work needs to be done to develop satisfactory tools for dealing with the distribution of people and enterprises in space.

Publications--USDA and Cooperative Program

RPA 108--ECONOMIC AND LEGAL PROBLEMS IN MANAGEMENT OF WATER AND WATERSHEDS

Beck, Robert E., and Newgren, Robert A. 1968. Irrigation in North Dakota through Garrison Diversion: An institutional overview. North Dakota Law Review. Vol. 44, No. 4. Summer. pp. 465-489.

Champion, William M. 1967. Prior appropriation in Mississippi: A statutory analysis. Miss. Law Jour. Vol. 39. pp. 1-38.

Davis, Peter N. 1968. Australian and American water allocation systems compared. Boston Indus. and Commercial Law Review. Vol. 9. pp. 647-700.

Ellis, Harold H. 1968. Legal aspects of rural-urban water use conflicts. In Proceedings, So. Agr. Workers, Rural and Soc. Section. 11 pp.

Ellis Harold H. 1967. State water rights and regulations as related to water and associated land resource planning and development. In Foreword to State Laws, Policies, and Programs. Vol. XI. Appendix J. Ohio River Basin Comprehensive Survey. pp. iii-xiv

Hines, N. William, ed. 1968. Nor any drop to drink: Public regulation of water quality. Reprint No. 10. Agr. Law Center, College of Law, Univ. of Iowa.

Hutchins, Wells A. 1968. The Idaho law of water rights. Idaho Law Review. Vol. 5. pp. 1-129.

Waite, G. Graham. 1967. A four-State comparative analysis of public rights in water. Dept. of Law, Univ. Extension, Univ. of Wisconsin. 56 pp.

RPA 908--IMPROVEMENT OF RURAL COMMUNITY
INSTITUTIONS AND SERVICES

- Cotner, Melvin L. 1968. Research perspective for sociological problems involving water resources. Workshop for Sociological Aspects of Water Resources Research, sponsored by Natural Resources Committee of Rural Sociological Society. Logan, Utah.
- Hanson, Ivan. 1968. Institutional changes required for effective natural resource conservation. Presented at annual meeting of Soil Conservation Society of America, Athens, Ga. 14 pp.
- Novak, Benjamin. 1968. A selected bibliography of special districts and authorities in the United States. U.S. Dept. Agr. Misc. Pub. 1087. 57 pp.
- Novak, Benjamin. 1968. Legal classification of special district corporate forms in Colorado. Univ. Denver Law Jour.
- Solberg, Erling. 1967. Comprehensive plans for improving rural counties. U.S. Dept. Agr. Agr. Inf. Bul. 316. 10 pp.
- Solberg, Erling. 1967. County planning counts when you buy a home. Yearbook of Agriculture. pp. 333-338

AREA NO. 4. LAND TENURE

USDA and Cooperative Program

Location of Intramural Work	Scientist Man-Years FY 1968		
	Research Problem Area		Total
	807	104	
Colorado		1.0	1.0
Virginia (Rosslyn)	0.5		0.5
Iowa	1.1		1.1
Michigan <u>1/</u>	1.0		1.0
Total	2.6	1.0	3.6

Intramural program is supplemented by 0.1 SMY at the University of Iowa (RPA 807).

1/ Reported in Area No. 10.

Problems and Objectives

The ownership and control of rural lands representing over \$300 billion of national wealth is variously distributed among 12 million owners. The conditions of ownership and terms of tenure affect the way in which resources are used and conserved and the way in which resource income is distributed. Studies of public and private access, ownership concentration and dispersion, estate management, contractual arrangements, and title and record information systems aid in determining how the public policies and programs influence resource use and the distribution of benefits and costs.

Major objectives of the research are to:

1. Identify patterns and trends in the structure of rural land-ownership and control.
2. Develop comprehensive title record and related information systems to improve land transfers, public administration, and land-use planning.
3. Identify legal impediments to efficient land use and develop alternative legal procedures and instruments for improved resource use.
4. Identify obstacles to access to public lands and public use of private lands.
5. Determine land income and use effects of alternative government programs.

Progress--USDA and Cooperative Program

RPA 807--STRUCTURAL CHANGES IN AGRICULTURE

Preliminary results of cooperative research at Ohio State University indicate that the use of EDP and other improvements in land-title recording procedures can result in savings both to local governments and individuals. Elaborate, quick storage and retrieval systems result in high benefit-cost ratios in areas with dense populations and heavy usage of land records. Rural counties may find it necessary to combine with other jurisdictions in order to obtain net benefits from improved record systems. For instance, the benefit-cost ratio for a random access microfilm system was 1.4 in an urban county while it was 0.6 in the rural county. In the next 10 years the aperture card system would yield benefits in excess of costs of over \$610,000 in Franklin County (an urban area), nearly \$35,000 in Fairfield County (an urbanizing rural area) and over \$9,000 in Hardin County (a predominantly rural area) if used in three county offices--recorder, clerk of courts, and probate court. The study investigated the use of four systems for handling real property records--the present system, an indexing system, an aperture card system, and a random access microfilm system in each of the three types of counties.

Research on the problems of improving the United States system of land titles and records was initiated through a workshop sponsored cooperatively with the Legal Aspects Subcommittee of the North Central Land Economics Research Committee. The workshop, with participants from England, Canada, and the United States, examined the present legal requirements for marketable title, recording, notice, title insurance policies and other requirements for the free transfer of land interests and the possibilities of an information-data system related to or combined with the land title system. Attention was focused on improved technological capabilities, such as improved computer, photogrammetric, and land survey techniques and on the specifications of components for an effective title and records system and the implementation of such a system. This data system might include information for tax assessments and collections, community planning and highway location, rural and urban zoning, enforcement of various codes and regulations regarding land use and occupancy, and research.

Comprehensive land records including title information hold potential for substantial savings in conveyancing. Using ownership parcels as an information base, data may be aggregated for many types of geographic areas, such as watershed or flood-plain district, as well as minor civil division and county. In addition to land-title records, other information entered might include soil type, slope, land use, and land value. If land records can be organized to supply data needs on operating units as well as ownership tracts, agricultural data such as censuses and sample surveys would be improved and expedited.

A study of land tenure in the United States, based primarily on 1964 Census of Agriculture data, was completed and a manuscript prepared for review. Findings are that in recent years: (1) The proportion of farms and land operated under various tenure arrangements have shifted toward more ownership and less tenancy; (2) the size of all farms has increased rapidly, but the increase has favored part owners at the expense of full owners and tenants; (3) the completeness of control of the owner over his land has weakened, owing to the demands of society for a better environment in which to live; (4) there is growing interest and demand for private access and use of public land, particularly for recreation; (5) off-farm income to many members of the various tenure groups exceeds their income from farming; and (6) nonwhites are still disadvantaged in regard to their access to, and claims on, land resources.

The second in a series of studies in estate management--joint ownership of personal property--was partially completed at the Agricultural Law Center in Iowa. This study is related to work completed last year on the joint ownership of real estate. The project involved (1) a library review of decisions and statutes, (2) field study of public records on security interests and study of probate inventories of decedents for the year 1964 in five selected Iowa counties. The library research indicated that the legal climate for joint ownership has improved over the past 10 years. Estate records were collected from 581 estates. The incidence of joint ownership is lower than expected from the previous real property study. The lower incidence of joint

ownership in estates can be explained by the fact that older persons would not have been as much affected by the recent expansion of interest in joint holding of property.

The Iowa Bar Association is now discussing reform of laws regulating joint ownership and has organized a special subcommittee for that purpose.

A study of the settlement of large farm estates in Iowa was initiated. This study is related to the previous work on joint ownership, and deals with intrafamily and intergeneration transfers of large estates. Problems will include administration costs, taxes, wills, and length of settlement.

The staff participated in international agrarian reform activities. The United States position on the final draft version of a recommendation concerning the conditions of life and work of tenants and sharecroppers was prepared. This recommendation was adopted by the International Labor Conference of June 1968. Membership on the North Central Research Committee workshop on rural institutions involved preparation, still in process, of a book on the role of reform of land tenure and other rural institutions in economic growth in less developed countries.

RPA 104--ALTERNATIVE USES OF LAND

The study of private access to public lands reported in detail last year was prepared for publication.

Work was initiated cooperatively with the Bureau of Land Management to analyze economic factors in modifying the public land management procedures of the BLM. The Bureau is designing and testing the land use and program planning portions of the new planning system (Section 1601, BLM Manual). The Economic Research Service is assisting in the development of decision criteria for public land use and management, procedures for data development, and procedures for field implementation of plans.

Publications--USDA and Cooperative Program

RPA 807--STRUCTURAL CHANGES IN AGRICULTURE

Cook, Robert N., and Kennedy, James L., Jr. eds. 1967. Proceedings of the Tri-State conference on a comprehensive, unified land data system (CULDATA). Univ. of Cincinnati. 253 pp.

Harris, Marshall, and Hildreth, R. James. 1968. Reflections on the organization of regional research activities. Amer. Jour. Agr. Econ. Vol. 50 (4).

Harris, Marshall, and Massey, Dean T. 1968. Vertical coordination via contract farming. U.S. Dept. Agr. Misc. Pub. 1073. 101 pp.

Strohbehn, Roger W. 1967. Possible benefits and savings from a CULDATA system. In Proceedings of the Tri-State conference on a Comprehensive Unified Land Data System (CULDATA). Univ. of Cincinnati. pp. 138-144.

Wunderlich, Gene. 1968. Extending extension through improved communication. Va. Farm Econ. No. 208, pp. 9-13.

AREA NO. 5. OUTDOOR RECREATION AND NATURAL BEAUTY

(RPA 902--OUTDOOR RECREATION)

USDA and Cooperative Program

Location of Intramural Work	:		Scientist Man-Years FY 1968
Virginia (Rosslyn)	:	:	1.0
Wisconsin	:	:	1.0
Michigan	:	:	0.0
Missouri	:	:	1.0
Total	:	:	3.0

Intramural program is supplemented by extramural support representing 1.0 SMY at State Agricultural Experiment Stations and 0.1 SMY at other U.S. institutions.

Problems and Objectives

Demands for outdoor recreation in rural areas are increasing. These demands stem largely from increasing urban populations with rising incomes, expanding leisure time and improving mobility. These trends provide the potential for increased incomes and job opportunities for rural people. Increased appreciation of aesthetics strengthens demands to maintain and improve the beauty of the countryside. Recognition is growing that the private sector has a significant role in expanding recreation facilities and improving natural beauty through rural resource development and management. Research information is needed to aid individual, local, and regional planning for recreation development, and analysis is needed of the economic benefits from development of rural area recreation.

Major objectives of the research are to develop and evaluate economic information on:

1. Demand for outdoor recreation in rural areas.
2. Costs and returns of outdoor recreation enterprises, and management and services required for successful operation.
3. Interrelationships between public and private recreation development.
4. Impacts of recreation developments on local economies.
5. Aesthetic considerations in outdoor recreation planning.

Progress--USDA Cooperative Program

A series of manuscripts reporting on several types of recreation enterprises is being developed through a cooperative project at the University of Wisconsin. Research reports covering vacation farms and cabin resorts are in final stages of publication. Other manuscripts reporting economic aspects of campground, fishing, riding stable, and shooting preserve enterprises are in the review process. A Ph.D. dissertation entitled, "Private Outdoor Recreation in Wisconsin: An Industrial Organization Analysis" was completed and publications are being developed from this research.

Field work in the Marquette-Alger area of the Upper Peninsula of Michigan has been completed. Analysis and manuscript preparation is proceeding on various phases of the case study including: an economic base study of the area; analyses of tourism and recreation demand; case studies of potential recreation developments; and an analysis of the public and private institutional arrangements that facilitate or constrain economic development of the tourism and outdoor recreation potentials in the area.

Research on improved procedures and methodology for evaluation of recreation as a major purpose in water resource development programs continued in cooperation with the University of Missouri. An econometric model designed to relate

recreation demands to alternative patterns of reservoir development was developed and is being tested through application to proposed reservoirs in the South Grande-Osage River Basin studies. Results and methodology are being developed into a final report on the project. Other cooperative studies of recreation supporting river basin planning activities are currently underway at the University of Nevada and the University of New Hampshire.

Companion papers entitled, "Demand for Outdoor Recreation" and "The Enterprise Analysis" were developed and presented at Outdoor Recreation Workshops sponsored by the Soil Conservation Service in New Mexico. An exploratory paper on the economics of natural beauty was presented at annual meetings of the Soil Conservation Society of America.

A small contract study was initiated to assess the potential for vacation farm enterprises. Emphasis is being given to the characteristics of successful managers and the present and potential role of vacation farms in the general recreation and tourism industry.

Considerable staff assistance was provided on recreation related activities. A staff member serves on the USDA Working Party on Outdoor Recreation which functions as a policy support staff for Departmental outdoor recreation programs and for Departmental participation on the President's Council on Recreation and Natural Beauty.

Publications--USDA and Cooperative Program

Brewer, Durward and Gillespie, Glenn A. 1967. Estimating satisfaction levels of outdoor recreationists. Jour. of Soil and Water Cons., Vol. 22, No. 6. Nov.-Dec. pp. 248-249.

Gillespie, Glenn A. and Brewer, Durward. 1968. Effects of nonprice variables upon participation in water-oriented outdoor recreation. Amer. Jour. of Agri. Econ., Vol. 50, No. 1. Feb. pp. 82-90.

Johnson, Hugh A. and Russell, Jesse R. 1967. Economics of natural beauty. Soil and America's Future, Proc. 22nd. Ann. Meeting Soil Cons. Soc. of Amer., Des Moines, Iowa. pp. 177-182.

AREA NO. 6. RESOURCE INCOME DISTRIBUTION

USDA and Cooperative Program

Location of intramural work	Scientist Man-Years FY 1968		
	Research problem area		Total
	104	807	
Colorado	0.9		0.9
Virginia (Rosslyn)	0.5	1.2	1.7
Total	1.4	1.2	2.6

Intramural program is supplemented by extramural support representing 0.6 SMY at State Agricultural Experiment Stations. 1/

1/ RPA 104, 0.4; RPA 807, 0.2.

Problems and Objectives

The economic well-being of rural and other people over time is determined by levels and distribution of income. Allocation of income to resources is influenced by the interrelationships of public programs, performance of resource markets, tenure and other institutions, and technological advance. An understanding of these interrelationships is necessary for ascertaining how rural people and rural communities are affected by public programs concerned with agriculture and natural resource development.

Major objectives of the research are to:

1. Develop models and parameters for evaluating alternative uses of land.
2. Estimate the costs and benefits of conservation and management programs and practices.
3. Determine the interrelationships between changes in structure of agriculture, farm programs, and income to the farm labor force.

Progress--USDA and Cooperative Program

RPA 104--ALTERNATIVE USES OF LAND

A survey of 153 participants and 217 nonparticipants in the Great Plains Conservation Program within the Central Great Plains indicated the major factors associated with participation in the program were size of farms, proportion of operating units in rangeland, levels of income, age and education of operators, and experience of operators in Federal programs--especially the conservation programs. Generally, acreages in operating units, higher proportions of land acreage in operating units, higher proportions of land acreage in range, higher income, highest years of schooling completed, and greater experience in Federal conservation programs. Also, participation rates were highest for full owners and lowest for full tenants.

A major obstacle to achievement of the objectives of the Great Plains Conservation Program for crop farms was the greater income to operators for use of land--even low grade cropland--for crops than for pasture. Nearly half of the cumulative Federal expenditures in cost sharing under the program in the 10-State region were for improving rangelands and water supplies in connection with ranching.

Regional accounts developed for a nine-county area in the Central Great Plains indicate community net income arising from the Great Plains Conservation Program is two to three times net benefits to the direct beneficiaries.

RPA 807--STRUCTURAL CHANGES IN AGRICULTURE

Major factors contributing to variation in income of rural people among Minnesota counties were location of counties relative to location of large cities, extent of local manufacturing, structure and type of agriculture,

age and education of the populations, and quality of the farmland. Generally, income of rural people was highest for those counties being nearer the major metropolitan centers, having greater amounts of nonfarm economic activity, and having higher quality of farmland. Farm real estate values tended to parallel the variation in income among the counties; however, quality of farmland was more important in explaining variations in land values than variations in income of rural people.

A study of flue-cured tobacco programs from the time of their inception to 1960 indicated (1) the principal beneficiaries of the programs were land-owners, and (2) laborers gained a share approximately equivalent to their long-run income earning opportunities in other employment. Thus, it was concluded that neither the tenure arrangements nor the flue-cured tobacco programs had significant long-run effects upon earnings of labor employed in tobacco production.

Publications--USDA and Cooperative Program

RPA 104--ALTERNATIVE USES OF LAND

Landgren, Norman. 1967. Some observations on agricultural conservation programs. In Proceedings, 1967 Western Farm Economics Association. pp. 161-170.

RPA 807--STRUCTURAL CHANGES IN AGRICULTURE

Back, W. B. 1968. Appraisal of regional, interregional, and national effects of resource development by interindustry analysis. Paper presented at NRED Symposium on Secondary Impacts. Washington, D.C. Sept. 25-27.

Back, W. B. 1968. Relevant questions for agricultural economics research. In Contemporary Agricultural Marketing, Irving Dubov, ed. Univ. Tenn. Press. pp. 3-14.

Bryant, W. Keith, and Hammill, Anne E. 1967. Industrialization, location and rural income levels. Minn. Farm Bus. Notes No. 501. 3 pp.

Cook, Neil R. 1968. Review of regional studies of income distribution. Paper presented at Symposium on Secondary Impacts, NRED, ERS. Sept. 25-27. Washington, D.C.

Hammill, Anne E. 1968. Farm real estate values in Minnesota. Minn. Farm Bus. Notes No. 509. p. 1.

Hedrick, James L., Tolley, George S., and Back, W. B. 1968. Effects of flue-cured tobacco programs on changes in the distribution of resource income. Econ. Res. Serv. ERS-379. 19 pp.

Wilber, George L. and Back, W. B. 1968. Rural poverty in Puerto Rico. In Rural Poverty in the United States. President's National Advisory Commission on Rural Poverty. pp. 141-146.

AREA NO. 7. QUALITY OF NATURAL RESOURCES

(RPA 901--A: LEVIATE SOIL, WATER, AND AIR POLLUTION)

USDA and Cooperative Program

Location of Intramural Work	:	Scientist Man-Years
	:	FY 1968
Virginia (Rosslyn)	:	1.0
Total	:	1.0

Intramural program is supplemented by extramural support representing 0.2 SMY at State Agricultural Experiment Stations.

Problems and Objectives

Public interest and concern about the quality of resources is reflected in recent legislation enacted at both Federal and State levels. Growing concern about possible adverse effects of agricultural operations is also evident. In some instances, efficiency of agricultural production and changes in resource quality are closely linked. Research is needed to develop economic information and to evaluate economic problems directly related to quality of natural resources in rural areas. Areas of major current concern are pesticide, fertilizer, and other chemical residues; animal wastes; sediment; and other land, water and air pollutants.

Major objectives of the research are to develop and evaluate economic information pertaining to:

1. The nature and sources of rural area pollutants.
2. Measurement of adverse quality impacts and trends in technological development that affect quality of land, water and air resources.
3. Evaluation of alternative measures for alleviating environmental quality problems.

Progress-USDA and Cooperative Program

A cooperative project at Iowa State University was continued. Physical science research has established that sediment movement is a major transmission mechanism for movement of pollutants, particularly agricultural chemicals and plant nutrients, from land source areas into water supplies. Major emphasis is being given to the identification of these and other adverse effects from sediment movement and the economic assessment of alternative methods for reduction of adverse impacts.

Some preliminary investigations of animal waste and sedimentation problems were carried out, and staff support was provided for Departmental and agency activities concerning environmental quality. Major committee activity included participation in Departmental staff assessment of current research and action programs, and projecting future needs for research on pollution problems in support of the OST Study of Environmental Quality. Pollutant areas under examination included sediment, plant nutrients, pesticides, animal wastes, crop residues, processing wastes, inorganic salts and minerals, and air pollutants.

Colorado River Basin planning studies are concerned with defining the relationships between water availability, water quality, and economic activity. Six input-output models were used in analyses for selected years and water resource situations--1960-1980 and 2010 and "unconstrained," "quantity constrained" and "quality constrained" projections. A study of the Wellton-Mohawk Irrigation District in Yuma County, Arizona indicated that salinity damages in 1980 will probably be negligible but a 1.8 percent reduction in value of output could result by 2010. (SMY's for this study are reported in Area No. 9).

Publications--USDA and Cooperative Program

Stewart, Clyde E. and Pincock, M. Glade. 1967. Impacts of water quality on the agricultural industry in the Colorado River Basin - an inter-industry study. In Proceedings, Committee on Economics of Water Development. Western Agricultural Economics Research Council, San Francisco, Calif. December. pp. 115-136.

AREA NO. 8. NATIONAL-INTERREGIONAL ANALYSIS
OF RESOURCE DEVELOPMENT

USDA and Cooperative Program

Location of Intramural Work	:	Scientist Man-Years
	:	FY 1968
Virginia (Rosslyn)	:	4.0
Man-years included in Area 1 report	:	2.5
Man-years included in Area 2 report	:	2.1
Total	:	8.6

No extramural support was provided for this area of work during the reporting period.

Problems and Objectives

Generalized plans are being formulated for the development of water and land resources for the Nation and for each of the water resource regions. Data and analyses are needed to support this planning. This includes establishing and maintaining a data base, developing an analytical framework, designing systems for data retrieval, and analysis, and for intra- and inter-agency coordination of analysis, and proceeding to integrate these phases to accomplish the over-all objective.

Major activities of this area of work include the following:

1. Developing a bank of data related to natural resources and systems for processing these data.
2. Projecting economic activity and resource use in the agricultural and related sectors for the Nation and water resource regions.
3. Adapting methods of analysis for application to studies of water and land resources in water resource regions.

Progress-USDA and Cooperative Program

A. Development of a Data System Related to Natural Resources

Efforts continued toward establishing an operational data bank for natural resource development analysis. At the beginning of the year the data bank contained several hundred selected items from the 1949, 1954, 1959, and 1964 Censuses of Agriculture plus the 1958 Conservation Needs Inventory. All of this data was specified to counties and programmed for combination and comparison with other counties.

During FY 1968, several new sets of data were added to the collection and improvements were made in the processing system. Revised 1966-67 Conservation Needs Inventory data were included for selected States. State acreage, production, and value data from the Statistical Reporting Service were included for all States, for about 80 crop and livestock items, for the years 1939-1966 inclusive. In addition, the processing system was converted to a third generation computer system and a major effort was made to pretest the accuracy of the system.

B. National-Interregional Analyses and Projections of Economic Activity and Resource Use in the Agricultural and Related Sectors

A continuing effort seeks to determine the probable influence of various factors on future geographic distribution of agricultural output and employment. The factors include Technology change, resource availability, transportation costs, and institutional arrangements. This activity is coordinated with the Office of Business Economics, Department of Commerce, which performs similar analyses with respect to the nonagricultural sectors of the national and regional economies.

Preliminary projections of agricultural production, employment and income, land use, and impacts on related sectors, completed in FY 1967, are now in use in framework studies in selected water resource regions of the United States. During FY 1968, the preliminary projections were revised to reflect new trends, particularly of population growth, and procedural refinements were made to improve the quality of projections. A technical supplement providing detailed projections was prepared for the Pacific Southwest area.

Arrangements were also made with the Bureau of the Census to obtain Minor Civil Division data from the Census of Agriculture in support of selected river basin studies.

C. Integrated Econometric Systems of Economic Analysis and Projections for Use in Framework Studies

Assistance in model building and data analyses is provided in direct support of river basin planning. At the beginning of the year, a Water Resource Region Agricultural Analytical and Projections Systems (WRAAPS) had been conceptualized in three phases--input, mathematical projections, and economic transformation. During FY 1967 progress was made on developing a generalized mathematical projections system. During FY 1968, progress was centered on the input phase. This included the development of a consistent land inventory and productivity system based on the Conservation Needs Inventory. It produces automatic records acceptable by the mathematical projections phase.

Publications--USDA and Cooperative Program

A. Development of a Data System Related to Natural Resources

Holm, Paul L. 1968. Data systems and information retrieval adaptable to water resources. In Proceedings of North Central Water Resources Research Seminar. Chicago. September.

B. National-Interregional Analyses and Projections of Economic Activity and Resource Use in the Agricultural and Related Sectors

U.S. Dept. of Agriculture, Economic Research Service and Forest Service. 1967. Preliminary projections of economic activity in the agricultural, forestry, and related sectors of the United States and its water resource regions, 1980, 2000, and 2020. Washington. For use of the Water Resources Council and cooperating agencies. August.

C. Integrated Econometric Systems of Economic Analysis and Projections for Use in Framework Studies

Green, William A. 1968. Orientation and scope of the USDA projections program in support of the Water Resources Council's planning activities. Paper presented at the Economic Conference of the Water Resources Council. Washington. March 12-13.

Holm, Paul L. 1968. National-interregional projections of agricultural production and systems of analysis. Paper presented at the Economic Conference of the Water Resources Council. Washington. March 12-13.

Great Plains Agr. Council. 1968. Projections of livestock feeding efficiency, 1980, 2000, 2020. Mo. River Basin States. Great Plains Agr. Council Publ. No. 31. Univ. of Nebr. M.P. 21. 23 pp.

AREA NO. 9. REGIONAL APPRAISALS FOR NATURAL
RESOURCE DEVELOPMENT

USDA and Cooperative Program

Location of Intramural Work	:	Scientist Man-Years
		FY 1968
Arizona	:	2.0
California	:	1.0
Michigan	:	2.6
Nebraska	:	1.8
Oregon	:	1.0
Pennsylvania	:	2.0
Utah	:	3.0
Total	:	13.4

Intramural program is supplemented by extramural support representing 2.5
SMY's at State Agricultural Experiment Stations.

Problems and Objectives

A critical need exists for comprehensive long-range regional planning for development and conservation of water and related land resources. Early resolution of problems associated with the planning of small areas is required as regional plans are developed. Proposed projects can fail to achieve optimal development because of less than full consideration of all needs and development potentials. A restricted or fragmented approach to planning also interferes with full consideration of alternative sources and costs of products and services obtainable from water development projects. In its report of January 1961, the Senate Select Committee on National Water Resources recommended that comprehensive plans be prepared for all major river basins of the Nation. This recommendation is being implemented by current coordinated planning efforts of a number of Federal agencies working under the general guidance of the Water Resources Council. Completion of the coordinated program of comprehensive surveys for major water resource regions of the Nation is scheduled for 1972.

Studies undertaken by the Natural Resource Economics Division, ERS, are coordinated with survey efforts of the Soil Conservation Service, the Forest Service, and other Federal Departments, and carried out under the general guidance of the Water Resources Council.

Major objectives of the work carried out by the Economic Research Service are to:

1. Analyze and project economic activity in the agricultural and related sectors of the economy.
2. Project the demand, supply and use of land resources for agricultural and other rural purposes.
3. Analyze agricultural and rural water problems as they relate to the volume, composition and value of production, employment, and levels of income in affected communities.
4. Assess agricultural and rural needs for water and related land resource development.
5. Appraise the economic effects and consequences of development alternatives on the agricultural and related sectors of the economy, and dependent rural communities.

In addition to the specific contributions to river basin studies, ERS personnel serve on numerous field task forces and committees. In some instances, ERS personnel serve as chairmen on interagency economic coordinating committees and assume responsibility for leadership on subcommittees and task force groups dealing with economic projections, plan formulation, water related land use management, recreation, and report preparation. In addition, they represent ERS as members of USDA Field Advisory Committees for each comprehensive river basin study.

Progress--USDA and Cooperative Program

The study of the North Atlantic Region continued. Basic crop cost budgets were completed by land resource areas. ERS personnel prepared several appendix reports to the overall report of the study. Included were a draft appendix on irrigation, which was distributed to members of the coordinating committee for review. Other appendix reports near completion are agriculture and forestry. Data reflecting future developments for agricultural products in the northeast was completed for inclusion in the appendix on land use and management.

Planning studies of the Great Lakes Basin (Michigan) were initiated during the year. Development of work plans and procedures, and assignments for carrying out the study were agreed upon. Collection of basic agricultural data for use in an economic base study was started. Agreement was reached on what data would be needed and how it would be presented for soil resource groups.

Review and revision of a draft appendix report on agriculture was completed for the Upper Mississippi River Basin study. Work is continuing on an economic base study and in plan formulation, the latter activity being carried out cooperatively by the SCS, Forest Service, Corps of Engineers, Department of the Interior, and other agencies and States. A working draft on the application of economic analysis in plan formulation was approximately 70 percent completed.

The Souris-Red-Rainy Basin study (Minnesota, South Dakota, and North Dakota) was started in December 1967, and work plans and assignment of agency responsibilities have now been completed. Projected agricultural production for the region was started. Information was collected for analyzing employment and income effects of changes in agriculture in the region. Crop production budgets were prepared as well as data on historical production and farm characteristics.

Activities in the Missouri River Basin included the development and use of the linear programming model for some preliminary projections of the agricultural economy by 1980, 2000, and 2020. Additional projections for 1980 included assumptions regarding use of marginal and idle land, changes in total production capacity, and production with yields reduced and increased 10 percent. Analyses of the 2020 projections were partially completed. Reports approved and issued include task force reports for eight subbasins prepared for the economic base study. Several chapters for agricultural economic portions of the overall report were prepared.

Agricultural production projections for 1980, 2000, and 2020 were revised for the Upper Colorado Region to reflect changes associated with use of different population projections. Crop budgets were completed and along with supporting data were transmitted to Washington for use in the national projections study. Procedures for collecting data and integrating analysis for timber resources including lumber, wood products, pulp, paper and allied products were developed for use in the economic base study.

Primary emphasis of the Lower Colorado River Basin study was placed on supplying information for the agricultural sectors to be used in the input-output analysis of regional water requirements. Data on historical and present characteristics of agriculture were compiled for use in projecting trends in future agricultural projections. Data were also collected and analyzed for preparation of crop yield and feeding efficiency projections. Budgets were completed for major crops in the region for land resource areas.

The subbasin report for the Colorado Economic Base Study on agricultural sectors of the input-output model for the Lower Main Stem Subbasin was revised and transmitted to the Federal Water Pollution Control Administration. An article summarizing the findings of the study was submitted to the Water Resource's "Research Journal." (See Area No. 7 for progress report on the study and citation of publication.)

Crop budgets for the Columbia-North Pacific Region were developed and sub-regional projections of crop and livestock output were completed and distributed for review. Other projections completed were agricultural food and kindred employment, crop yields, and fertilizer uses. Several drafts for appendices reports were completed for review.

The framework study for the California Region continued during the year. Primary emphasis centered on preparation of yield projections necessary for expressing projected commodity levels in terms of land and water requirements. Regression projections of historical regional trends, plus subregional yield and index numbers for 1959-67 were completed for 50 crop and livestock products produced in the region. Regional analysis to develop supplementary projections of California's share of national food and fiber requirements was approximately 50 percent completed.

Publications--USDA and Cooperative Program

River basin reports prepared in limited quantity, primarily for use by cooperating agencies.

Economic Research Service, in cooperation with Soil Conservation Service and Forest Service. 1968. Agricultural and related economic development--Upper Mississippi River Basin comprehensive basin survey. Chapter IV of Appendix N, Agriculture.

Stechmesser, Gary R. 1968. An agricultural production function for the Columbia-North Pacific Region. Corvallis, Oreg. 71 pp.

Udis, Bernard (ed.) 1968. An interindustry analysis of the Colorado River Basin in 1960 with projections to 1980 and 2010. Univ. of Colorado. Prepared for Federal Water Pollution Control Administration, U.S. Dept. of the Interior. Includes 9 volumes, each with agricultural portions prepared by ERS staff.

Papers prepared in limited number for participants, NRED Symposium on Secondary Impacts, September 25-27, 1968. Washington, D.C. Single copies available upon request prior to publication of Symposium Proceedings.

Andersen, Jay C. and Wilkes, Lynn W. The consideration of secondary impacts in comprehensive studies of the Pacific Southwest Water Resource Regions.

Back, W. B. Appraisal of regional, interregional, and national effects of resource development by interindustry analysis.

Cook, Neil R. Review of regional studies of income distribution.*

Cox, P. Thomas. Statistical analyses of growth and development in project areas or potential project areas.

Gadsby, Dwight M. Current procedures used in evaluating resource conservation and development projects.

Harrison, Robert W. The role of secondary effects in project formulation, justification and evaluation for the Appalachian water resources survey.

Heneberry, William H. Evaluation of secondary benefits from the accelerated watershed program in Appalachia.*

Long, Burl F. Concepts and theoretical basis for evaluation of secondary impacts.*

Miller, Walter G. and Osborn, James E. Secondary impacts of land and water depletion.*

Skold, Melvin D. and Greer, Arthur T. Jr. Estimating the impact of individual resource development projects in local areas by interindustry analysis.

Stewart, Clyde E. Secondary benefit evaluations in Federal reclamation programs.

Strohbehn, Roger W. Computer simulation of a sociophysical system.

Taylor, Gary C. Relating economic evaluation of Federal resources programs to political objectives and social values.*

Weinberger, M. L. Concepts and objectives underlying the evaluation of secondary effects of natural resource development.

* Paper cited also in "Area" reports.

AREA NO. 10. RIVER SYSTEMS PLANNING

USDA and Cooperative Program

Location of Intramural Work	:	Scientist Man -Years FY 1968
Arkansas	:	3.0
Colorado	:	1.0
Florida	:	1.0
Michigan	:	4.7
Mississippi	:	1.0
Missouri	:	1.0
Nebraska	:	1.5
New Hampshire	:	1.0
New Mexico	:	1.0
New York	:	1.0
North Carolina	:	1.0
Oklahoma	:	1.7
Oregon	:	3.5
Pennsylvania	:	2.0
South Carolina	:	1.0
Texas	:	2.0
Utah	:	1.0
West Virginia	:	1.8
Wisconsin	:	.7
Total	:	30.9

Intramural program is supplemented by extramural support representing 5 SMY's at State Agricultural Experiment Stations.

Problems and Objectives

The way our water and related land resources are developed and used is a matter of concern in many areas of the country. Major problems involving water resources and river basins stem from water shortages, causing distress in both rural and urban areas; deterioration of water quality; increased demand for water resulting from increased population and growth of water-using industries; depletion of ground-water supplies; and development of water storage sites.

Major objectives of the river systems planning studies are to provide economic data and analysis for:

1. Planning effective programs involving complete consideration of benefits and adverse effects.
2. Improving utilization and efficient distribution of water supplies among competing uses and areas.
3. Achieving profitable use of capital available for resource development.
4. Improving design and scheduling of projects.

Progress--USDA and Cooperative Program

Current investigations concern development of improved methods for river systems planning; participation in plan formulation for river basins and sub-basins, including investigations to identify and evaluate economic needs for development in rural areas, and analyses of benefits and costs of development alternatives; and economic review of Federal agency reports on proposed water resource developments. Most of the investigations are applied economic research which contributes to interagency-interdepartment comprehensive studies. Survey data and analyses for this area of work are prepared for use mainly by participating agencies.

Research at field locations is cooperative with the Soil Conservation Service, the Forest Service, and in some instances, with State water resource agencies, the Corps of Engineers, the Public Health Service, and other public agencies. Survey activities of the Federal agencies are coordinated by the Water Resources Council.

Although similar in subject matter to work described in Area No. 9, survey activities reported in this area are more detailed than those reported in Area No. 9 and cover areas smaller than the major water resource regions for which "framework plans" are developed. Plans for subbasin areas are of such character that specific projects needed within the next 10 to 15 years are identified. Subbasin plans are expected to be consistent with the framework plans of water resource regions. Objectives and criteria are of such nature as to require improved and more complete analytical systems. Investigational

efforts are focused, therefore, on the types of analyses that contribute to optimal choices in the planning process regarding location, combination of purposes, scale, and scheduling of water resource developments.

During the period reported, staff members participated in more than 35 active studies. These included interagency basin studies coordinated by the Water Resources Council, basin studies carried out mainly in cooperation with State agencies and coordinated by USDA agencies, and studies designed to provide additional information on analysis of special problems.

River basin studies follow a similar, though not identical, approach. They include, initially, a study of the economic base in the region under investigation. Data and analysis pertaining to the agricultural economy are compiled by ERS staff and combined in an overall report on the region's economic base with economic reports of other sectors provided by other cooperating agencies. Other major contributions to river basin planning are economic projections, evaluation of development alternatives, and analysis of probable economic impacts of installed structures and other resource developments. As is true for "framework studies" reported in Area No. 9, economic projections are coordinated nationally and regionally by the Economic Research Service and the Office of Business Economics, U.S. Department of Commerce. Thus, it is intended that projected supply and demand for basin production, as derived from basic projections of income and population, be compatible with national projections. Where data are adequate and time and staffing are sufficient, impact analyses have been made to estimate the economic consequences of proposed measures and programs in relation to activity projected in the absence of the development.

Because studies often are operationally similar, a few are reviewed here to illustrate work underway and progress during the reporting period.

An analysis of the potential for economic development was prepared for a major subbasin of the Central Lahontan Basin (Nevada). Land status in the Basin was determined as part of the analysis. This study showed that the area within the city limits of Reno and Sparks increased from 5,628 acres in 1948 to 14,503 in 1965. Land within city limits increased 522 acres per year during this period, but not all land changed uses. About 44 percent of the land within city limits was vacant. Even with this vacancy factor and population densities of 6.2 persons per acre in Reno and 8.8 in Sparks, land area suitable for urban use appears sufficient to meet projected needs in the year 2020. The analysis was discussed with extension agents, work unit conservationist, and foresters for the purposes of evaluating statements, checking consistency of data, and evaluating clarity of the results. An economic base report incorporating the data and analysis were prepared as part of a larger interdepartmental study of the Basin.

Airphoto interpretations were used to analyze past and probable future trends in agricultural land use as one phase of the Susquehanna River Basin Study (Pa. and Md.). Another part of this overall study involved an evaluation of the economic impacts expected to result from construction of ten Corps of Engineers' reservoirs. Findings of this study were incorporated in a report

that summarizes displacement effects on the rural economy of the area. This information constitutes part of the contribution to the interagency report on the Basin. A report on the agricultural economy of the Basin with projections of agricultural activity for 1970, 1985, and 2020 was also prepared to present the findings to the public.

A computer analysis was developed for the Wabash River Basin (Indiana and Illinois) to translate acreage and production of flood, feed and roughage crops into various categories of livestock production. Levels of crop and livestock production were broken down into basin and subbasin requirements for labor, and water. Estimates of farm employment and farm population associated with projected levels of production were also derived as part of the analysis. Input data were compiled for different water resource development activities, such as drainage, irrigation and flood protection. These data were used in computer runs to obtain development projections for the years 1980, 2000, and 2020. The computer output from these machine runs was assembled into tabular for further analysis and evaluation. Based on the computer and other detailed analysis, a manuscript was prepared for inclusion in the interdepartmental report for the Basin.

As a part of the study of the Big Sioux River Basin (South Dakota) intensive analysis of recreation was initiated. Estimates of historical and projected use of recreational facilities were made, including consideration of changes in population, income, and participation rates, as well as the types of activities suitable for the area and competing facilities outside the study area. Preliminary estimates were made of the available and projected supply of recreation facilities. This analysis indicated that recreation benefits would not be available in a large segment of the Basin. Location of recreation facilities close to major urban areas would be required to justify their development. The findings from this study will be provided interdepartmental agencies for use in planning resource developments in the Basin.

A linear programming analysis was made of proposed water resource developments in the White River Basin (Arkansas) in order to evaluate economic impacts from the program. The analysis indicated some limitations of the programming procedure but it demonstrated a promising alternative for evaluating benefits claimed for the proposed resource developments. Differences between justification of regional developments as contrasted to national needs for the proposals were illustrated by the LP procedure. Results of the impact study were incorporated into an economic base report which is a part of the interagency coordination publication. A technical bulletin on the impacts of the proposed projects is planned.

Special studies are conducted on a variety of technical subjects as an aid to river basin planning. An example of these special investigations is a study of land values and flood risk relationships being carried out in the Wabash River Basin, under an agreement with the Corps of Engineers. During the reporting period, sales of land located wholly or partially on flood plains were identified and yield and production costs on those lands determined from a survey. Purpose of the study includes determining probable benefits of specific flood control projects for different stream reaches of the Basin.

In addition to specific contributions to river basin studies, ERS personnel serve on numerous task forces, interagency and Departmental committees associated with river basin planning. In some instances, ERS personnel assume responsibility for leadership on subcommittees and task force groups dealing with plan formulation and report preparation. In addition, they represent ERS as members of USDA Field Advisory Committees for each river basin study.

Publications--USDA and Cooperative Program

The following river basin reports were prepared in limited quantity for use by cooperating Federal and State agencies:

- Braden, Johnny D. 1968. Economic base study of the Independent and Coastal Streams, Mississippi and Louisiana. ERS. Little Rock, Arkansas.
- Braden, Johnny D. 1968. Outdoor recreation demand for the Independent and Coastal Streams market area, Mississippi and Louisiana. ERS. Little Rock, Arkansas.
- Consulting Services Corporation. 1968. Economic study of Puget Sound and adjacent waters--projections: 1980, 2000, and 2020. Includes agricultural analysis performed by ERS. Seattle, Washington. Processed. 160 pp.
- Greenhalgh, Richard. 1968. Economic base study for the Chickasaw economic study area, Tennessee and Mississippi. Little Rock, Arkansas.
- Greenhalgh, Richard. 1968. Economic base study for the Hatchie economic study area, Tennessee and Mississippi. Little Rock, Arkansas.
- Harris, Gene. 1968. Agricultural impacts of proposed projects in the White River Basin comprehensive plan. ERS. Little Rock, Arkansas. Contributed to Appendix B to Main Report for White River Basin Study.
- Jones, Gary. 1968. Economic development and outlook, St. John's River Basin, (Florida). ERS. Gainesville, Florida. Contribution to USDA report for the St. John's River Basin and intervening coastal areas.
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AREA NO. 11. NATURAL RESOURCE MANAGEMENT
FOR COMMUNITY DEVELOPMENT

USDA and Cooperative Program

Location of Intramural Work	:	Scientist Man-Years
		FY 1968
Virginia (Rosslyn)	:	2.0
Georgia	:	1.0
Arkansas	:	1.0
Michigan	:	.9
Utah	:	1.0
Total	:	5.9

Intramural program is supplemented by extramural support representing (a) 0.1 SMY at State Agricultural Experiment Stations, and (b) 0.1 SMY at other U.S. institutions.

Problems and Objectives

This area of work is concerned primarily with providing technical assistance and conducting studies of economic feasibility and impact as a part of the Resource Conservation and Development Projects Program authorized under provisions of the Food and Agriculture Act of 1962. An RC&D project is a locally initiated and sponsored activity. The objective of the program is "to expand the economic opportunities for the people of an area by developing and carrying out a plan of action for the orderly conservation, improvement, development and wise use of their natural resources."

The program of technical assistance and applied research consists of four activities:

1. Technical assistance in formulating the economic aspects of the local RC&D project plan.
2. Economic studies of project proposals having implications beyond the project area.
3. Evaluation of economic effects resulting from project activities in selected project areas.
4. Assistance in program planning and development at the national level.

This program of economic support is guided by annual work plans prepared under a Memorandum of Agreement with the Soil Conservation Service effected in 1964. There are currently 51 projects authorized for planning or operations. Nearly all projects involve multicounty areas.

Progress--USDA and Cooperative Programs

A. Technical Assistance in Formulating Project Work Plans

During this year, some form of assistance was provided to project sponsors in 41 States. This activity included the assembly of basic socioeconomic data and recent trends, consultation with the sponsoring groups, and assistance in making probable estimates of the impact on incomes and employment from installation of proposed project measures for 18 States. This activity provides information for use by project technicians in assessing an area's economic potential. Local area statistical profiles prepared for this purpose by ERS personnel include such items as population, labor force, migration trends, income, land use, agriculture, etc. In many cases the data are included in project plans.

B. Economic Studies of Proposed Project Measures

A study carried out under contract for ERS summarized and evaluated the Gwinnett County (Georgia) RC&D project. Estimates were made of income and employment created by the project since its inception. The study recognized that zoning is important in Gwinnett County and similar areas adjacent to

metropolitan centers and recommended that Gwinnett's planning commissions and local RC&D officials recognize the need for "greenbelt" laws. The study concluded that one of the most important contributions of RC&D has been its role as a catalyst for groups of individuals interested in Gwinnett County's future development.

In another study that examined the economic impact of the Crow-Wing Canoe Trail (Minnesota), it was noted that expenditures directly traceable to users of the trail represented only a part of the total impact in economic terms to the project area. Assuming that each dollar expended generated from \$0.50 to \$1 of additional income, the authors estimated a total local dollar impact from the trail of approximately \$85,000. The authors also noted that considerable interest in real estate has been generated by the canoe trail and that it may be the most direct form of investment interest in the area which has been devised.

A set of statistics on the economics of catfish production, tracing production costs from the producer to the retailer, was compiled for general conditions existing in the South. The statistics relate to average conditions and are intended to be used for general guidance in evaluating catfish processing as a potential business enterprise.

C. Evaluation of Economic Impacts

Continued attention was given to evaluation of economic impacts in selected project areas.

A method was developed to estimate economic impact of RC&D measures in terms of changes in employment, income, and community improvement. Basic information for the evaluation obtained periodically for each project measure includes scheduling of installations, source of funds, estimated construction costs and continuing expenditure associated with each practice, and estimated change in employment by type of employment. This evaluation was applied to four of the original 10 RC&D projects, including West-Central (Minnesota), Penn-Soil (Pennsylvania), Gwinnett County (Georgia), and Upper Willamette (Oregon). The four projects represent a continuum of development, from a rural project area in Minnesota to suburban Gwinnett County in Georgia. The evaluations were made with the assistance of project coordinators and use the method discussed above. Estimated total expenditures generated by the project ranged from \$4 million in the Minnesota project to nearly \$26 million in Gwinnett County. Income increases associated with these investments were estimated to amount to about twice the expenditure. As a check on the consistency of these results, it is significant to note that a separate study of the Gwinnett County RC&D project area yielded results in close agreement to those arrived at for Gwinnett County in the four-project comparative evaluation.

An important feature of this estimating method is its value for assisting in the selection of possible project measures among alternatives. Having made an evaluation of expected income and employment effects, a community is in a position to allocate scarce resources to those project measures that provide

the greatest increases in employment and income. A paper in which the estimating method is described and which discusses considerations of local resource development programs was prepared for the Secretary's Handbook.

Other activities during the year included preparation of a report for the Commission on Rural Poverty relating resource development problems to the incidence of rural poverty, and study of local multipliers at the county level. Aspects of RC&D project evaluation--current procedures, concepts, and outstanding issues--were analyzed in a paper prepared for the NRED Symposium on Secondary Impacts. Now near completion is a study of the impact on a local economy of the installation of a summer home community at the site of a man-made lake in Pennsylvania.

D. Program Assistance at the National Level

Staff work was carried out in cooperation with SCS personnel, and a number of RC&D project work plans were reviewed and comments provided. ERS economists attended two SCS regional meetings in order to present their systems and views on the approaches involved in economic impact analysis.

Publications--USDA and Cooperative Program

Gadsby, Dwight M. 1968. Current procedures and concepts used in evaluating natural resource development in the RC&D program. Paper presented at the NRED Symposium on Secondary Impacts. September 25-27.

Taylor, Gary C. 1968. Relating economic evaluation of Federal resources programs to political objectives and social values. Paper presented at the NRED Symposium on Secondary Impacts. September 25-27.

In addition, numerous items were prepared for multiple distribution and local use. These items include statistical profiles, estimates of impact, and other working material; and usually to specific RC&D project areas.



